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# Physicians' use of the personal digital assistant (PDA) in clinical decision making

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**Purpose:** This study examined how frequently attending physicians and physicians in training used personal digital assistants (PDAs) for patient care and explored physicians' perceptions of the impact of PDA use on several areas of clinical decision making.

**Setting/Subjects:** The 108 participants included 59 attending physicians and 49 physicians in training from teaching hospitals in Tennessee, Florida, Alabama, Kentucky, and Pennsylvania.

**Methodology:** Respondents completed a questionnaire designed to explore PDA use in a clinical setting.

**Results:** Eighty-seven percent of the respondents reported PDA use for patient encounters. Fifty-five percent of respondents reported frequent use, and 32% reported occasional use of a PDA for patient care. Of the frequent PDA users, 85% said PDA use had influenced their overall clinical decision making and 73% mentioned treatment alterations specifically. Approximately 60% of the participants reporting occasional PDA use indicated that the PDA had influenced their overall clinical decision making, while 54% specifically mentioned a change to their patient's treatment plan.

**Discussion/Conclusion:** Attending physicians and physicians in training who used a PDA during patient encounters perceived that even occasional PDA use had an impact on their clinical decision making and treatment choices. Health sciences librarians are perfectly positioned to provide PDA training and assistance not only to physicians who are frequent PDA users, but also to those who are occasional users.

## INTRODUCTION

Information retrieval for health care professionals is a subject of major interest, but it also poses a formidable challenge. Previous studies addressing this issue from the standpoint of health care professionals' information needs have focused specifically on the needs of physicians [1–3], nurse practitioners [4], nurses [5, 6], interns, and residents [7, 8]. Handheld computers, usually called personal digital assistants (PDAs), have introduced a new tool and venue for information retrieval. The portability of the PDA facilitates information retrieval at the point of patient care. Recent research on PDAs has focused on prominent PDA use among physicians, medical students, residents, and interns [9–11]. Recent studies have also reported on the frequency of PDA use by clinicians [9, 11–14]. This study was conducted to build on the data from previous research on medical use of PDAs, to examine the frequency with which attending physicians and physicians in training used PDAs for patient care, and to explore perceptions of the impact of PDA use on clinical decision making, diagnosis, treatment, test ordering, and patient length of stay.

## METHODS

This study was a multistate effort using physicians in teaching hospitals from 5 states, with the sample recruited at 5 hospitals. The convenience sample was comprised of 64 physicians from Tennessee, 26 from Florida, 10 from Pennsylvania, and 4 each from Alabama and Kentucky. The 108 participants included 59 attending physicians (55%) and 49 physicians in training (45%). For purposes of this study, the terms "physicians in training" and "trainees" applied to medical students, interns, and residents. The attending physician group (attendings) consisted of 17 females (29%) and 42 males (71%), while the trainee group was composed of 18 females (37%) and 31 males (63%). Study participants were required to have and use a PDA, but prior training with a PDA was not required because the study intended to determine the participants' perceived PDA skill level at the time of the survey. None of the participating libraries offered PDA training prior to the study's completion.

The PDA study was marketed by librarians sending emails and making announcements at medical meetings, morning reports, and hospital seminars. Data were collected from questionnaires distributed to physicians and collected at medical meetings and by email, mail, and facsimile. In addition to the specific research questions, participants provided demographic information regarding their profession, training status, age, and gender. Nonresponders received a telephone call and two reminders.

Participants responded to a questionnaire (Appendix) designed to explore PDA use in the clinical setting. Participants were presented with an array of frequency intervals with five Likert-scale answer choices:

almost always, often, a few times, rarely, or never. For ease of reporting, respondents who answered "almost always" or "often" were combined and reported as frequent users, while respondents who answered "a few times" or "rarely" were combined and reported as occasional users.

Attending physicians and physicians in training were asked how often they used their PDAs before, during, or after patient encounters. A separate section of questions asked whether the use of their PDAs influenced the participants' patient care decision making, changed their diagnosis of a patient, changed a patient's treatment, avoided unnecessary tests, or shortened a patient's length of hospital stay. The questionnaire provided a space for participants to fill in comments to expand their answers to each question.

Several phases of analysis were performed. The researchers looked at the data pertaining to the perceived frequency of PDA use for patient encounters by the entire population of 108 participants. The data were then divided into the groups of attendings and trainees and analyzed according to training level. Following the analysis of the data on the frequency of PDA use for patient care, the second phase of analysis addressed whether or not respondents felt PDA use for patient care had an impact on five aspects of clinical care:

- decision making
- diagnosis of a patient
- treatment
- medical test requests
- length of patient stay

The final phase of the analysis studied the relationship between the frequency of PDA use and its impact on patient care. Of the entire sample of 108 physicians, 94 (87%) reported PDA use for patient encounters. This population was separated into the 59 respondents who reported "frequent" use and the 35 who reported "occasional" use. The 2 groups were then compared as to the perceived impact of PDA use for patient encounters on the 5 aspects of clinical care. The results were additionally parsed by training group of either attending physicians or physicians in training. Data from respondents who stated they never used PDAs for patient encounters were not analyzed any further.

Statistical analysis of all phases included chi-square tests to assess differences between attending physicians and physicians in training regarding the frequency of PDA use and the influence of PDA use on clinical care. Chi-square testing was also used to evaluate the impact of PDAs on clinical care among all respondents as they related to various aspects of care. MiniTabs software was used for all statistical analyses. A significance value of  $P < 0.05$  was considered statistically significant.

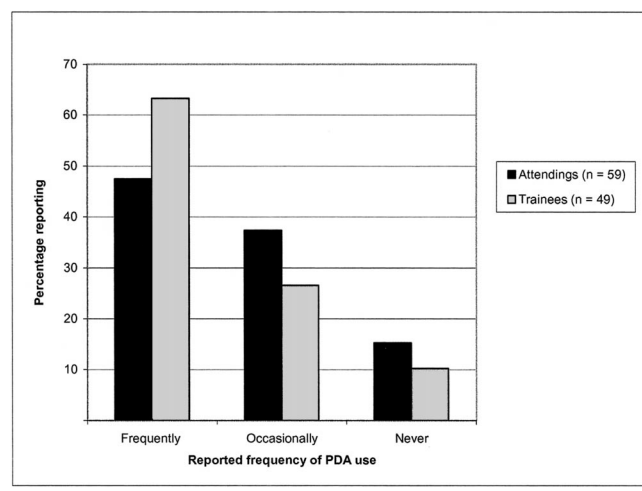
## RESULTS

### Frequency of personal digital assistant (PDA) use for patient encounters

Fifty-nine (55%) of the respondents reported frequent use of PDAs before, during, or after patient encounters.

**Figure 1**

Reported frequency of personal digital assistant (PDA) use for patient encounters by training level



ters. This finding suggested that a slight majority of the overall population of respondents frequently used PDAs for patient encounters. An additional 35 respondents (32%) of the group surveyed indicated they occasionally used PDAs for patient encounters. Taken together, the results indicated that 94 of the 108 participants (87%) used PDAs at least occasionally for patient encounters. An overwhelming majority of respondents were using their PDAs in a patient care setting.

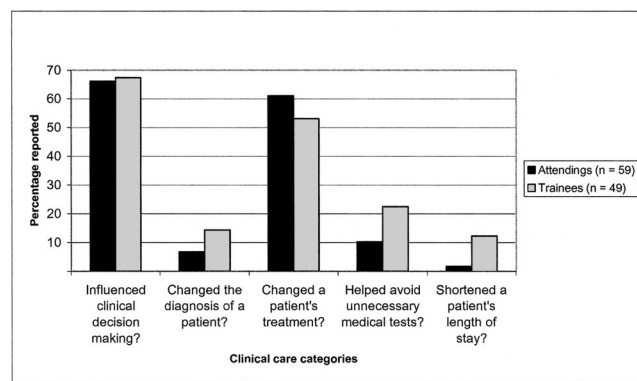
A comparison of PDA use for patient encounters by the two groups differentiated by training level found that the individual groups of attending physicians and physicians in training emulated the results of the entire population and found that there was no significant difference ( $P = 0.10$ ). Sixty-three percent of the 49 physicians in training and 47% of the 59 attending physicians indicated they used their PDAs frequently. Similarly, no significant difference was found ( $P = 0.234$ ) for the attending physicians (37%) and trainees (27%) who reported occasional PDA use for patient encounters and again no significant difference between the 15% of attendings and 10% of trainees ( $P = 0.437$ ) who answered that they had never used a PDA for patient encounters. Although a slightly larger percentage of trainees reported frequent PDA use, there was no significant statistical difference between the two groups in the percentages of each use category (Figure 1).

### Impact of PDA on clinical care

When asked, 67% of all the participants reported that using a PDA for patient care had influenced their clinical decision making. Over 50% of the respondents indicated PDA use helped change a patient's treatment. Sixteen percent of the population stated that using a PDA helped avoid unnecessary medical tests. Only 10% of the total group said PDA use had helped

**Figure 2**

Impact of PDA use for patient encounters on clinical care



change a patient's diagnosis, and 6% perceived that using a PDA had shortened a patient's length of stay.

A comparison of the data between the 59 attendings and the 49 trainees showed no significant differences between the attending physicians and the physicians in training on the various responses about PDA use for patient encounters in clinical care. Nearly the same percentage of attending physicians (66%) and physicians in training (67%) reported that PDA use had an impact on their clinical decision making. Similarly, 61% of attendings and 53% of trainees responded that PDA use helped change a patient's treatment ( $P = 0.405$ ). Although twice as many trainees as attendings indicated that PDA use had helped change their diagnosis of a patient (14% versus 7%,  $P = 0.218$ ) and helped avoid unnecessary tests (22% versus 10%,  $P = 0.081$ ), the disparity between the 2 groups was not significant. A similar trend was discovered relating to the effect of PDA use on patient length of stay, as only 12% of physicians in training and 2% of attending physicians admitted PDA use shortened a patient's length of stay ( $P = 0.493$ ) (Figure 2).

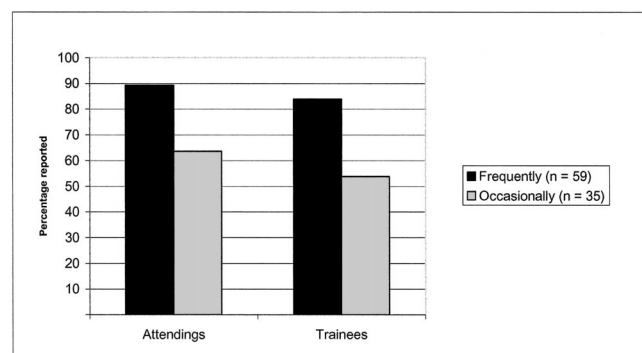
### Strength of occasional use of PDAs for patient encounters on clinical care

The significant findings of PDA use in clinical care were not limited to frequent PDA users. This study also looked at the relationship between the occasional uses of the PDA for patient encounters combined with the data on the perceived impact of PDA use on several aspects of clinical care. There were no significant effects of group membership (trainees versus attendings) in these areas.

**Clinical decision making.** Looking at the whole sample, more than 85% of the 59 respondents who were classified as frequent users of PDAs for patient encounters acknowledged that PDA use influenced their decision making. Sixty percent of the 35 respondents who were classified as occasional users of PDAs during patient encounters indicated that PDA use had had an impact on their decision making. A significantly

**Figure 3**

Percent of attendings and trainees reporting impact of frequent and occasional use of PDAs on clinical decision making



greater proportion of frequent PDA users indicated the tool had influenced their clinical decision making over the occasional PDA users ( $P < 0.007$ ); however, it is important to note that even occasional PDA use clearly showed a perceived impact on physician decision making (Figure 3).

**Treatment alterations.** Twenty-three (82%) of 28 attending physicians and 20 (65%) of the 31 physicians in training who identified themselves as frequent users of PDAs during patient encounters acknowledged that PDA use changed their treatment plans. Thirteen (59%) of the 22 attendings and 6 (46%) of the 13 trainees who were classified as occasional users of PDAs during patient encounters acknowledged that PDA use had contributed to a treatment alteration.

**Patient diagnosis.** Sixteen percent of respondents who reported frequent use of PDAs for patient encounters acknowledged that their PDA use had changed a patient's diagnosis. Fewer than 3% of respondents who reported occasional PDA use for patient encounters noted their PDA use had changed a patient's diagnosis.

## DISCUSSION

The data in this study showed that many of the participants used their PDAs at the point of patient care on an occasional (55%) or frequent (32%) basis (87% combined). In a 2004 study, McAlearney et al. pointed out that limited research had explored physicians' experiences with PDAs, particularly regarding patient care. Their study of doctors' experience categorized participants based on their PDA use [13]. They found that 83% used a PDA in various clinical settings, while 17% did not. De Groote and Doranski surveyed 1,538 health sciences faculty and residents but found that only 23% of residents used their PDAs for patient care [12]. However, resident use was reportedly higher for such functions as drug databases (82%) and medical references (51%). In the current study, physicians who made comments when asked to describe how PDA use

**Table 1**

Has the use of your personal digital assistant (PDA) influenced your decision making?

Category of comment	Number of comments	Percent of comments
Drug choice, interaction, or dosage	48	79.0%
Diagnosis or differential diagnosis	4	6.6%
Used as a reference	7	11.5%
Other	2	3.2%

had an impact on patient care reported either checking the PDA for drug information or a medical reference 91% of the time (Table 1).

## Impact of the frequency of PDA use on clinical care

The analysis of the data on the perceived impact of PDA use on specific areas of clinical care found 67% of the entire population reported that when they used a PDA for patient care, the outcome of the PDA use influenced their decision making. Sixty-one (56%) of the 108 participants volunteered comments to expand on their answers to the question, "Has the use of your PDA influenced your decision making?" Although the percentage of respondents who made a comment constituted only slightly more than 50% of the entire population, several interesting findings emerged from a tabulation of the comments. More than 75% of the comments pertaining to the question of the influence of the PDA on decision making involved drug-related information such as the use of ePocrates Rx, dosages, drug interactions, and drug choices.

Rothchild et al. found a similar trend in regard to patient decision making [14]. In that study, 79% of respondents reported that the use of ePocrates Rx increased the respondents' self-reported drug knowledge and contributed to improved drug-related decision making. The majority of users (72%) indicated that at least 1 clinical decision per week was favorably affected by use of ePocrates Rx.

Over 50% of all respondents in this study indicated that PDA use had changed a patient's treatment, while 16% admitted that using a PDA had avoided unnecessary medical tests. Forty of the 108 participants entered a comment to expand on their response to the question, "Has the use of your PDA changed a patient's treatment?" More than 80% of the comments regarding changing a patient's treatment involved looking at drug information. One attending physician commented that the use of a PDA "supported selection of more appropriate, safer, better treatment," while another mentioned that the use of ePocrates helped "in avoiding drug interactions" (Table 2).

These data were consistent with the published literature. Carroll and Christakis surveyed 1,185 pediatricians' perceptions of the strengths and weaknesses of PDAs using a 5-point Likert scale questionnaire and found that both PDA users and nonusers felt that PDAs could improve health care by decreasing medical errors [15]. Similar research by Rothchild et al. showed that a majority (63%) of 946 clinicians who



**Table 2**

Has the use of your PDA changed a patient's treatment?

Category of comment	Number of comments	Percent of comments
Drug choice, interaction, or dosage	33	82.5%
Check treatment (tx) options	4	8.3%
Saved time	3	7.5%

responded to an online survey concerning ePocrates felt that the drug database had the potential to reduce adverse drug events [14].

Only 10% of the total group in the current study reported that PDA use had helped change a patient's diagnosis, while 6% percent perceived that using a PDA shortened a patient's length of stay. There was no reported corroborating hospital data from the printed literature.

### Correlation with decision making

Over 85% of the 59 respondents who were classified as frequent PDA users for patient encounters indicated the use of a PDA had an impact on their clinical decision-making process. This finding suggested, not unexpectedly, a strong association between frequency of use for patient care and whether the respondents' perceived PDA use had played a decisive role in their clinical decision making. A surprising discovery in this study was that 60% of the 35 respondents who were classified as only occasional users of PDAs during the patient encounter period acknowledged that PDA use had influenced their decision making. When the data for occasional users was analyzed according to training level, 64% of attendings and 54% of trainees stated PDAs had an impact on decision making. This finding implied that even occasional PDA use before, during, or after patient encounters might have an impact on clinical decision making. The data showed that the same trends were evident for both attendings and trainees.

### Correlation with treatment alterations

A similar pattern emerged in the analysis of the respondents' treatment alterations by frequency of PDA use at the point of care. Of the participants reporting frequent PDA use, 73% changed their treatment plans, while 54% reporting occasional PDA use specifically said they altered their patients' treatment. When the data were examined according to training level, 59% of attendings and 46% of physicians in training classified as only occasional users of PDAs during patient encounters acknowledged that PDA use had contributed to a treatment alteration.

Again, the data indicated that even occasional use of the PDA before, during, or after patient encounters could have an impact on patient therapy decisions. Occasional users from both groups made comments related to treatment alterations, including one attending who mentioned that PDA use allowed him to "change

medication or dose" and a physician in training who remarked that PDA use "allows you to see/remember more treatment options."

### Correlation with patient diagnosis

The results showed that less than 20% of frequent PDA users and less than 3% of occasional PDA users were using PDAs as aids for patient diagnosis decisions. Trends for attendings and physicians in training were consistent with that of all respondents. Potentially, new PDA diagnostic tools, such as McGraw-Hill's Diagnosaurus, might encourage more PDA use for physicians' decision making that relates to patient diagnoses. Further research will be needed to monitor this question.

### Implications for librarians

The results of this study are important to the broad health-related community associated with PDA use, including health sciences librarians, because these librarians often provide clinical information retrieval services and instruction to attending physicians and physicians in training. This study implies that health sciences librarians might take particular note of the positive impact of PDAs on clinical decision making, treatment decisions, and diagnosis decisions for both frequent and occasional physician users. For librarians who are evaluating and delivering electronic health care information services and resources and providing PDA training, this study implies that the audience for PDA services and training is broader than previously reported, because the physician audience not only includes the *frequent* PDA user, but also the *occasional* PDA user. The wider audience can expand the opportunities for PDA medical information retrieval, PDA training, and any other services health sciences librarians might offer. Additionally, the research might help librarians build a stronger argument for focusing library staffs and monies on PDA instruction and software for attending physicians and physicians in training.

### LIMITATIONS

The data from this study cannot be broadly generalized to the entire population of PDA users, because the small sample is a sample of convenience from five campuses gathered through local announcements at medical meetings, morning reports, and special events. In addition, as a self-reported survey, the study is subject to potential limitations due to response bias.

### CONCLUSION

This research provides significant data on the impact of PDAs on clinical decision making and patient care. The attending physicians and physicians in training who identify themselves as frequent users of a PDA during patient encounters report that the PDA has in-

fluenced their clinical decision making. While this finding alone is important and builds on the current literature about PDA usage, the results of this study go beyond the previous findings and suggest that even occasional PDA use during patient encounters can leave physicians with the perception that PDAs influence their clinical decision making and help alter treatment choices in a positive manner.

Health sciences librarians providing PDA resource training will be encouraged by the findings of this study. These findings imply that increasing clinical PDA resources and providing training for the PDA for the wide audience of attending physicians and physicians in training who are both frequent and occasional PDA users can have a far-reaching positive impact on clinical decision making, diagnosis, treatment, test ordering, and patient length of stay, particularly with regard to drug decisions. Academic health sciences librarians and hospital librarians are perfectly positioned to provide both access to clinical PDA resources and PDA resource training that can have a positive impact on clinical care.

## FUTURE STUDIES

Although this study examined the frequency of PDA use in the clinical setting, the authors did not attempt to separately quantify PDA use before, during, and after patient encounters. Future research with larger samples of physicians might explore difference in use among attendings versus physicians in training or between novice and experienced PDA users. In addition, no training was provided to physicians prior to the study. It would be useful to know if training provided by librarians increases PDA use for various areas of clinical decision making. Further study will be needed to answer these questions. Further research might measure how long participants have been using PDAs, make distinctions between users with regard to the PDA software programs they own, and explore differences between novice and expert PDA users.

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## APPENDIX

### PDA use in the clinical setting

The purpose of this survey is to collect information about the use of personal digital assistants (PDAs) in clinical settings. Please fill out the information to the best of your ability.

### Demographic information

Name: \_\_\_\_\_

Gender:

\_\_\_\_\_ Female

\_\_\_\_\_ Male

Age:

\_\_\_\_\_ < 25

\_\_\_\_\_ 25-34

\_\_\_\_\_ 35-44

\_\_\_\_\_ 45-54

\_\_\_\_\_ 55-64

\_\_\_\_\_ 65 or older

Circle the level of medical training you have:

Attending Physician

Trainee (medical student, resident, or intern)

### The impact of PDA use in clinical settings

With regard to before, during, or after patient encounters, how often do you use your PDA:

Almost always

Often

A few times

Rarely

Never

Has the use of your PDA:

Influenced your clinical decision making?

Yes \_\_\_\_\_

No \_\_\_\_\_

If yes, please explain: \_\_\_\_\_

Changed the diagnosis of a patient?

Yes \_\_\_\_\_

No \_\_\_\_\_

If yes, please explain: \_\_\_\_\_

Changed a patient's treatment?

Yes \_\_\_\_\_

No \_\_\_\_\_

If yes, please explain: \_\_\_\_\_

Helped you avoid unnecessary medical tests?

Yes \_\_\_\_\_

No \_\_\_\_\_

If yes, please explain: \_\_\_\_\_

Shortened a patient's length of stay?

Yes \_\_\_\_\_

No \_\_\_\_\_

If yes, please explain: \_\_\_\_\_